



ENVIRONMENTAL STEWARDSHIP AND NATURAL RESOURCES MANAGEMENT

Contributions by NOAA's Great Lakes Environmental
Research Laboratory (GLERL)

— A SYNOPSIS —

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CONTAMINATED SEDIMENTS AND HABITAT ALTERATION

GLERL's contaminated sediments research:

- helped identify sediments as a major repository for toxic organic contaminants;
- is contributing to the development of a National Sediment Inventory;
- is contributing to the development of sediment quality criteria and the development of national protocols for assessing contaminated sediments needed by states, private industry, and other federal agencies;
- is one of the few programs developing methods to measure the toxicity, bioavailability, and bioaccumulation of sediment-associated contaminants in freshwater invertebrates for use on freshwater systems.
- contributed to the experimental design and implementation of, and performed bioassays and provided fate and transport data for, the Assessment and Remediation of Contaminated Sediments (ARCS) Program, Green Bay Mass Balance Program, and Upper Great Lakes Connecting Channels Program, and is presently contributing to the Lake Michigan Mass Balance Program.

Knowledge and expertise developed at GLERL has provided a scientific basis for NOAA natural resource damage assessments concerning contamination of bottom habitat off the coast of California.

Knowledge and expertise developed through GLERL research assisted the Coast Guard with assessment of habitat risk posed by, and development of balanced interim regulations for, the disposal of cargo residues in the Great Lakes.

PHYSICAL LIMNOLOGY AND HAZARDS

GLERL's Pathfinder model is being used for hazardous materials and oil spill trajectory forecasts in the Great Lakes by the NOAA HazMat Office in support of Federal and State On-Scene Coordinators and the interagency Regional Response Team; it is also used regularly by the U.S. Coast Guard to help direct search and rescue operations.

Products from GLERL's prototype Great Lakes Coastal Forecasting System for Lake Erie are used by the National Weather Service, municipal water supply managers, recreational boaters, marina operators, and fishermen.

GLERL's physical limnology group quantified the causes of high speed bottom currents that occur in Lake Champlain. These currents cause frequent episodes of bottom sediment resuspension and transport, making toxic contaminants attached to the sediment particles repeatedly available to lake water. This has become an important factor in planning for water quality restoration in the lake basin.

A study of bottom currents at a lake trout spawning shoal in Lake Superior was completed. The Gull Island Shoal in Lake Superior is one of only a few remaining sites where successful spawning of a native Great Lakes lake trout population occurs. GLERL's collaborative study with the U.S. Fish and Wildlife Service has shown that a unique combination of physical characteristics have contributed to sustained viability of this remnant fish stock. Such physical factors are important when planning costly efforts to restock lake trout and to replenish lost spawning substrate.

AQUATIC NONINDIGENOUS SPECIES

GLERL's ecosystem-based aquatic nonindigenous species research:

- is the most comprehensive investigation of the effects of the zebra mussel on Great Lakes ecosystems;
- produced an assessment of zebra mussel influence on contaminant exposure and showed that zebra mussels may be a significant new vector for moving contaminants into the food chain;
- first alerted the public and scientific community to the progressive eradication of the native unionid clam population in Lake St. Clair; this alerted the Mississippi River unionid industry of the pending threat before zebra mussels actually entered that system.
- is a significant component of the Saginaw Bay National Watershed Initiative; there is a clear need to reevaluate Saginaw Bay ecosystem management plans to incorporate the effects of zebra mussels;
- is shifting focus to more specific ecosystem problems that have arisen and which seem related to the zebra mussel invasion, such as extensive regrowth of aquatic weeds, nuisance algal blooms, changes in fish species, and the effects of zebra mussels on underwater cultural and recreational resources, such as shipwrecks.

NUTRIENTS AND BIOGEOCHEMISTRY

When GLERL was established a major issue was the spreading eutrophication of the Great Lakes caused by nutrient overenrichment. GLERL's research and subsequent development of nutrient models during the late 1970s contributed to the understanding of nutrient dynamics in the Great Lakes and recognition that additional expenditures for sewage treatment and lowering of the allowable phosphorus loads from sewage treatment plants would not be effective, because of the major nutrient signal from sediments already in the system. As a result of testimony based on GLERL's research (among others), the EPA abandoned a proposal to lower allowable phosphorus concentrations in effluents entering the lakes, thus saving the American taxpayers billions of dollars in additional sewage plant modifications.

GLERL's world class environmental radiotracer program has developed sediment geochronology techniques used to assess past environmental impacts (retrospective analyses) in aquatic ecosystems. This technique is presently being applied to reconstructing the environmental history at several Great Lakes sites, in Florida Bay and the Everglades, in Lake Coeur D'Alene (Idaho), and in Terrace Lake (Colorado), and to diagnosing the impact of the 1994 Midwest floods on the redistribution of contaminated sediments in the Mississippi River basin.

GLERL helped introduce the use of sediment traps and sediment resuspension studies in the Great Lakes, and pioneered research using stable isotopes as natural environmental tracers in the Great Lakes, with applications to identifying and tracing contaminant sources and distributions, contaminant mass balance, ecosystem processes, and retrospective analyses. Results have been incorporated into contaminant mass balance models used by resource managers to develop remedial action plans for areas where contaminated sediments are a concern, such as the Upper Great Lakes connecting channels and Green Bay. This expertise is now being applied to the development of a contaminants mass balance for the Lakewide Management Plan (LAMP) being developed for Lake Michigan. It was also applied as part of a major NOAA study of nutrient and carbon fluxes at the Mississippi River outflow and their relationship to a large zone of near-bottom hypoxia in the northern Gulf of Mexico (Nutrient Enhanced Coastal Ocean Productivity [NECOP] Program).

FRESHWATER RESOURCES

GLERL provides technical support and expertise to the boards of the International Joint Commission and their supporting agencies for the operation of Great Lakes water level regulation facilities and development of Great Lakes water management policy.

GLERL's new Coupled Hydrologic and Atmospheric Research Model (CHARM) incorporates hydrologic and lake thermodynamic models with a regional atmospheric model for the Great Lakes; it will facilitate improved probabilistic hydrologic forecasts, water resource management decisions, and climate change investigations by operational and research agencies in the U.S.

GLERL has developed, and continues to improve, hydrologic models of the 121 Great Lakes drainage basins and the seven lake surfaces for use in operational forecasting and management of Great Lakes water resources by the U.S. Army Corps of Engineers, hydroelectric power utilities, and other agencies.